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AN ILLUSTRATED KEY TO THE SPECIES OF *TYRRELLIA* (PROSTIGMATA: LIMNESIIDAE)

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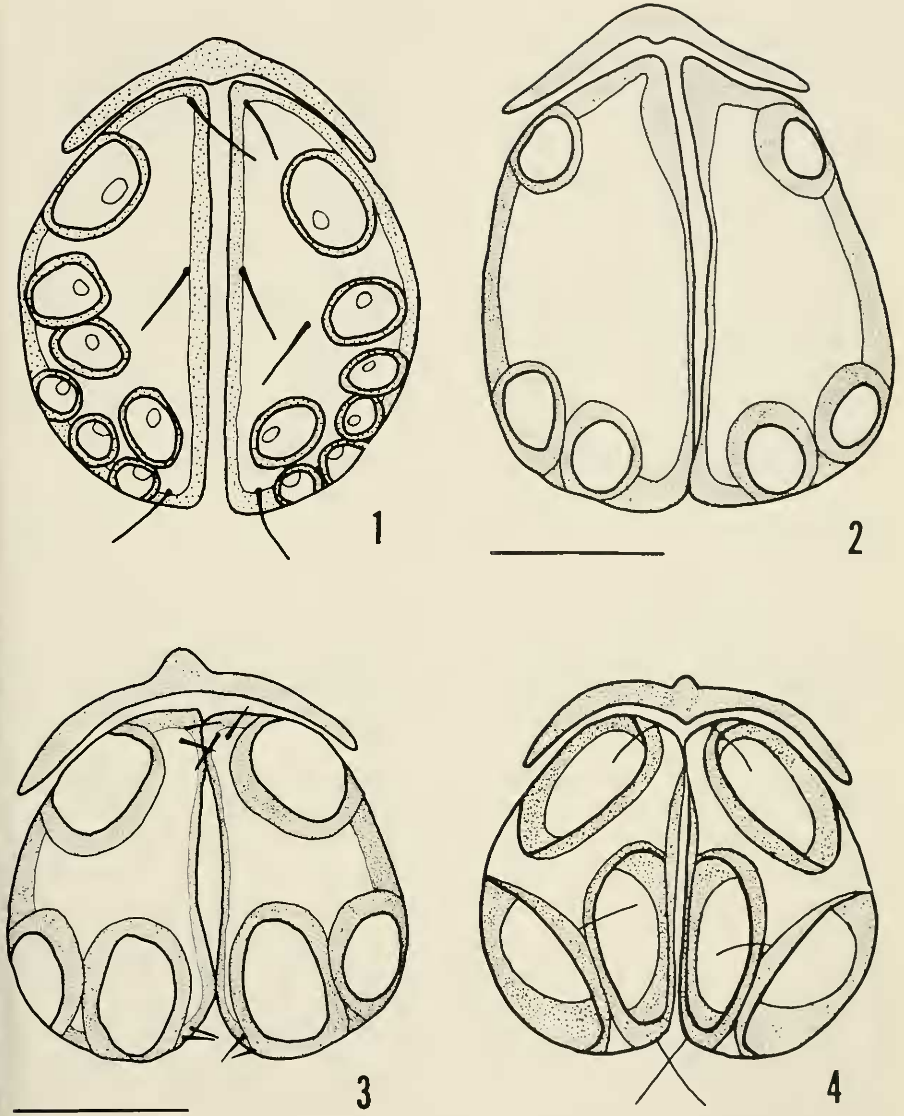
Abstract.—Water mites of the New World genus *Tyrrellia* Koenike are reviewed, and a key is presented for the seven known species.

The New World genus *Tyrrellia* is a small genus of water mites composed of seven described species. The typical habitats of these mites are the moist margins of both running and standing water (Cook, 1974). Specimens seem to be more commonly collected at the edges of springs and springbrooks than in other aquatic environments. Mitchell and Mitchell (1958) have discussed several of the adaptations of *Tyrrellia* for existence in the thin film of water characteristic of their habitat. The genus is thought to have originated in South America (Mitchell and Mitchell, 1958).

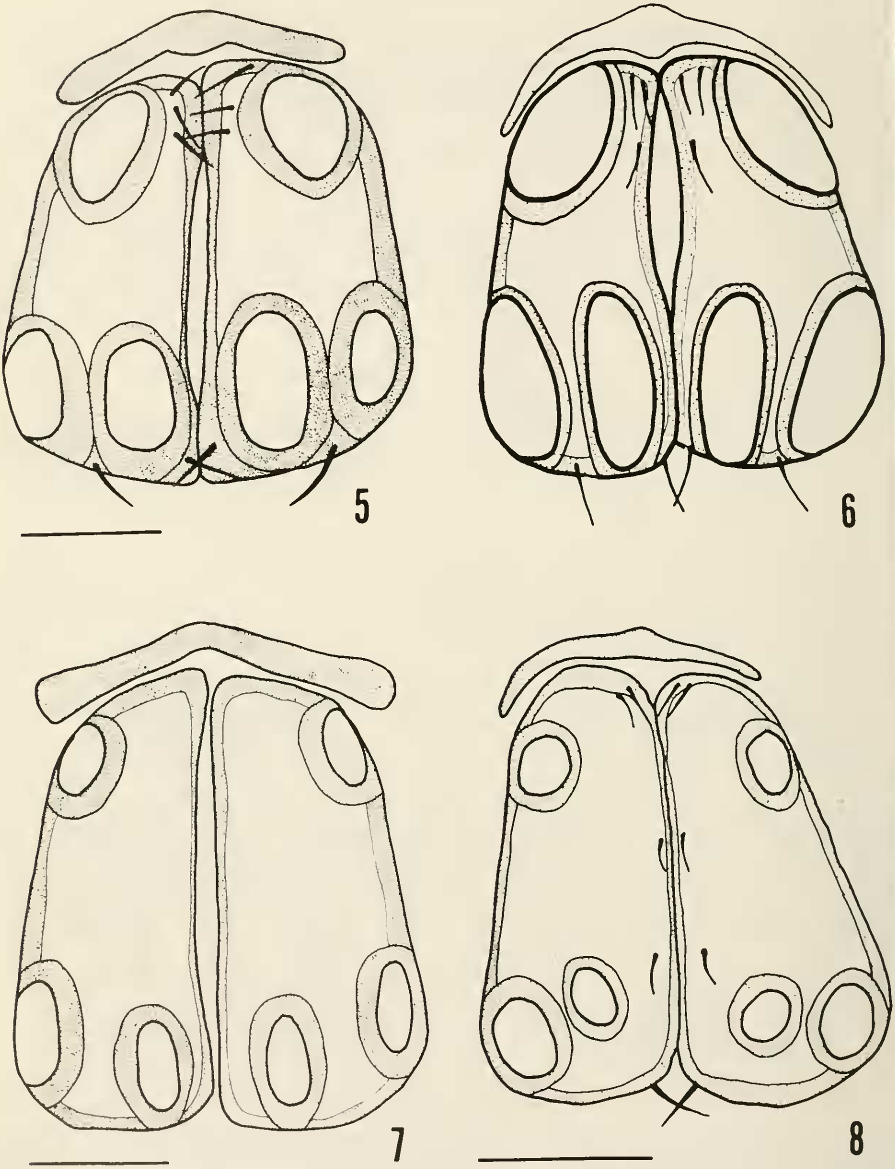
Diagnostic characteristics of the family Limnesiidae and the genus *Tyrrellia* are treated in some detail by Marshall (1940) and Cook (1974). Besch (1962) gave a key to the species of *Tyrrellia*, but the key contained several diagnostic errors.

Key to Species of Adult *Tyrrellia*

1. Six to 7 pairs of genital acetabula (Fig. 1); Florida (subgenus *Scutotyrrellia*) .... *scutata* Cook
– Three pairs of genital acetabula (Fig. 2) (subgenus *Tyrrellia*) 2
2. Anterior dorsal plate unpaired (Figs. 9, 10) 3
– Anterior dorsal plate paired (Figs. 11, 12) 4
3. Acetabula small and uncrowded (Fig. 2); structure of 4th leg as in Fig. 15; Chile .... *noodti* Besch
– Acetabula large and crowded (Fig. 3); structure of 4th leg as in Fig. 16; North America .... *circularis* Koenike
4. Anterior dorsal plates extending to or above the rear of the eyes (Fig. 11) 5



Figs. 1–4. Genital field of adult *Tyrrellia* spp., ventral view. 1, *T. scutata*, ♀ (redrawn from Cook, 1974). 2, *T. noodti*, ♀. 3, *T. circularis*, ♀. 4, *T. crenophila*, ♂ (redrawn from Lundblad, 1941). Scale lines = 100 μm.



Figs. 5–8. Genital field of adult *Tyrrellia* spp., ventral view. 5, *T. hibbardi*, ♀. 6, *T. ovalis*, ♀ (redrawn from Marshall, 1940). 7, *T. ovalis*, juvenile ♀. 8, *T. australis*, ♀. Scale lines = 100 μm.

– Anterior dorsal plates not extending to or beyond the rear of the eyes (Fig. 12) 6

5. Acetabula of male and female large and crowded (Fig. 4); structure of 4th leg as in Fig. 17; Central and South America .... *crenophila* Lundblad

– Acetabula of male and female small and uncrowded (Fig. 5); structure of 4th leg as in Fig. 18; Kansas .. *hibbardi* Mitchell and Mitchell

6. Anterior dorsal plates small and oval, only slightly longer than wide (Fig. 13); 4th leg less than 300 μm in length (Fig. 19); female with acetabula large and oval (Fig. 6); North America .... *ovalis* Marshall

– Anterior dorsal plates rectangular, more than twice as long as wide (Fig. 12); 4th leg greater than 300 μm in length (Fig. 20); female with acetabula small and round (Fig. 8); Chile .... *australis* Besch

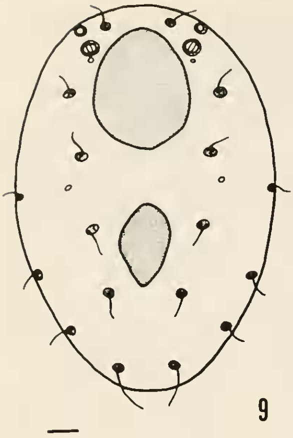
REMARKS ON *TYRRELLIA* SPECIES

Tyrrellia scutata is the only species in the subgenus *Scutotyrrellia* and is known only from its type-locality in Florida (Cook, 1974). Though the actual habitat is unknown, Cook (1974) suggested that the species inhabits open water rather than the water margin, based on the length of the leg segments.

Tyrrellia australis and *T. noodti* are known only from Chile where they occur at the margins of springs (Besch, 1962). *Tyrrellia crenophila* is another South American species, recorded from Brazil and Paraguay as well as El Salvador (Lundblad, 1941). It was collected in seepage areas at the water margin.

The species with the most widespread distribution is *T. circularis*. Specimens have been collected throughout North America in California, Colorado, Texas, Kansas, North Dakota, Michigan, Illinois, Ohio, Tennessee, North Carolina, Florida, and Ontario. It usually occurs at the wet margins of streams and lakes, but specimens have been collected at the edges of hot springs (Marshall, 1940) and mineral springs (Young, 1969). McDaniel and Bolen (1979) collected a single female of *T. circularis* in a soil sample taken two meters from a lake shore. In Besch's 1962 key, *T. circularis* is separated from *T. noodti*, in part, by lacking a tapering posterior margin on the rear dorsal plate. The shape of this plate in *T. circularis* is highly variable, often tapering posteriorly. Habeeb (1975) described a new subspecies, *T. circularis bicentensis*, based on this atypical tapering of the rear dorsal plate. Lanciani (1978) reported larvae of *T. circularis* parasitic on pupae and adults of two species of Ceratopogonidae, *Dasyhelea grisea* (Coquillett) and *D. mutabilis* (Coquillett). The adult stage of the mite was found to be predaceous on the immature stages of several ceratopogonids.

Tyrrellia hibbardi is known only from several springs in southwestern Kansas. It is restricted to wet margins at the spring source where water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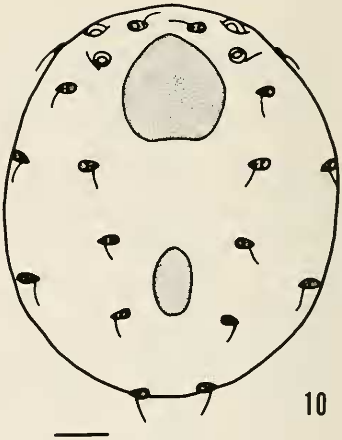
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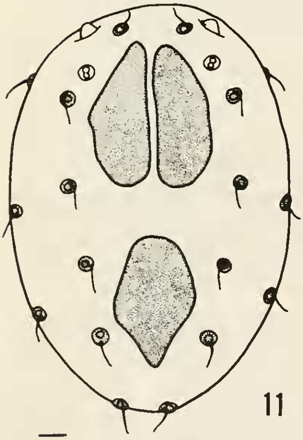
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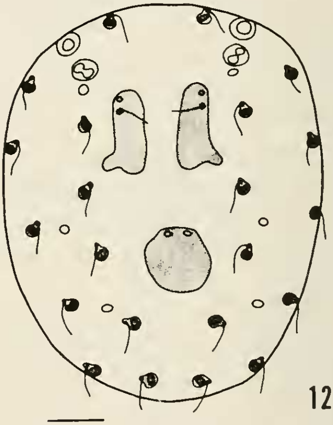
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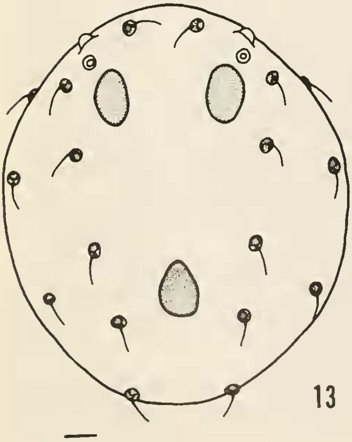
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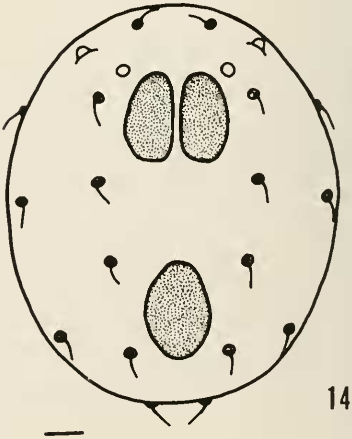
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temperature remains relatively constant year round (Mitchell and Mitchell, 1958). In the springbrooks, *T. hibbardi* is replaced by *T. circularis* and *T. ovalis*.

The records for *T. ovalis* are rather scattered, though it is probably a widely distributed species in North America. It has been recorded from Kansas, North Dakota, Wisconsin, Michigan, and Illinois. As for other *Tyrrellia*, it occurs at the margins of lakes and streams. In Besch's 1962 key, *T. ovalis* is identified on the basis of a paired posterior dorsal plate. In the original description, Marshall (1932) described two small posterior plates, but in a redescription, Marshall (1940) said this character was extremely rare. In the 61 specimens I examined from throughout the United States, the posterior dorsal plate is entire.

In collections of *T. ovalis*, juveniles are usually more abundant than adults. Only 12 adults were found, and only juveniles were present in collections from North Dakota, Kansas, and Illinois. Although there was no significant morphological variation detected in the various populations of juveniles examined, the juvenile form was noticeably different from the adult in overall size (Table 1) and in the form of both the acetabula (Fig. 7) and the anterior dorsal plates (Fig. 14). The overall size difference was significant ($P \leqslant 0.01$) as was the distance between the anterior plates ($P \leqslant 0.01$). Evidently, as the mite grows larger the anterior plates spread apart. Without careful identification, the juvenile of *T. ovalis* could be confused with the female of *T. hibbardi*; however, the shape of the acetabula (Figs. 5, 7) and the overall body size (Figs. 11, 14) will clearly distinguish the two species. Measurements of *T. hibbardi*, the only other North American *Tyrrellia* with paired anterior plates, were tabulated by Mitchell and Mitchell (1958).

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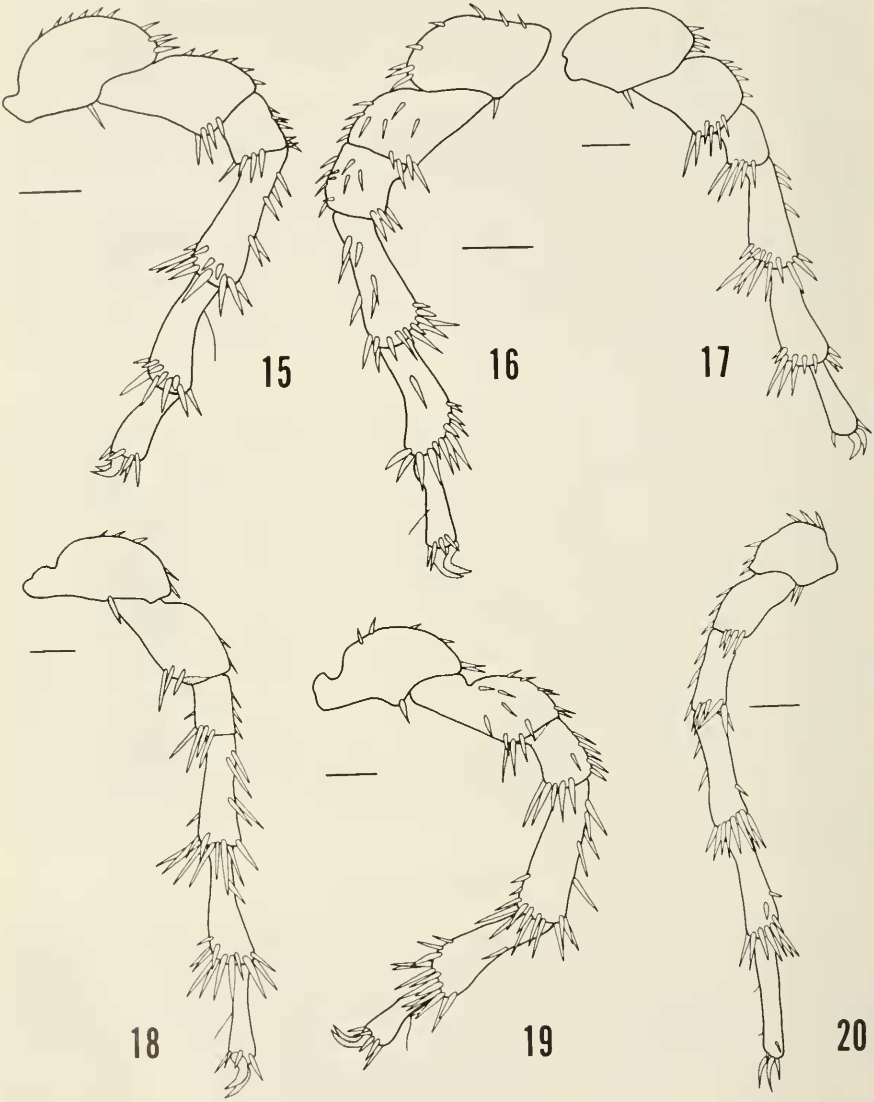
Figs. 9–14. Dorsal surfaces of adult *Tyrrellia* spp. 9, *T. noodti*, ♀. 10, *T. circularis*, ♂. 11, *T. hibbardi*, ♂. 12, *T. australis*, ♀. 13, *T. ovalis*, ♀. 14, *T. ovalis*, juvenile ♀. Scale lines = 100 μm.



Figs. 15–20. Fourth leg of adult *Tyrrellia* spp., ventral view. 15, *T. noodti*, ♀. 16, *T. circularis*, ♀. 17, *T. crenophila*, ♂ (redrawn from Lundblad, 1941). 18, *T. hibbardi*, ♀. 19, *T. ovalis*, ♀. 20, *T. australis*, ♀. Scale line = 100 μm.

Table 1. Means and standard deviations (μm) for several morphological parameters of *Tyrrellia ovalis*.

	Juvenile	Adult
Overall length	855.0 ± 194.3	1365.7 ± 307.9
Overall width	740.0 ± 148.0	1156.4 ± 206.2
Length of anterior plates	154.7 ± 62.6	144.2 ± 33.3
Width of anterior plates	81.4 ± 14.4	104.7 ± 32.9
Distance between anterior plates	63.5 ± 32.0	118.8 ± 25.4
Length of posterior plate	155.7 ± 38.5	140.3 ± 59.7
Width of posterior plate	115.7 ± 18.9	114.6 ± 22.9

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